

What is claimed:

1. A method of preparing a printed circuit board (PCB), comprising the steps of:
forming a hole in a substrate to form a via having a sidewall extending
therethrough;
depositing a first conductive material on opposite sides of the substrate and on the
sidewall of the via;
filling the via with a second conductive material to plug the via such that the via
has no opening extending completely therethrough in a direction generally perpendicular to
the opposite sides of the substrate; and
depositing a third conductive material on the first conductive material and on ends
of the second conductive material in the via.
2. The method according to claim 1, wherein the step of forming the hole
comprises one of drilling the hole, punching the hole, laser drilling the hole, and forming
the hole by photo-definition.
3. The method according to claim 1, wherein the first conductive material
comprises copper.
4. The method according to claim 3, wherein the step of depositing the first
conductive material includes electrolytically depositing the first conductive material to a
substantially uniform thickness of greater than approximately 0.2 mils.
5. The method according to claim 4, wherein the substantially uniform thickness is
approximately 0.5 mils.
6. The method according to claim 1, further comprising the step of masking the
substrate with a stencil to permit selective filling of the via prior to the step of filling the
via.

7. The method according to claim 1, wherein the second conductive material is a conductive ink.

8. The method according to claim 7, further comprising the step of curing the conductive ink prior to the step of depositing the third conductive material.

9. The method according to claim 8, further comprising the step of removing any of the conductive ink extending out of the via prior to the step of depositing the third conductive material.

10. The method according to claim 7, wherein the conductive ink comprises at least one of silver, copper, and a noble metal.

11. The method according to claim 1, wherein the step of depositing the third conductive material comprises one of feature plating and panel plating, and the third conductive material comprises copper.

12. The method according to claim 11, wherein the step of depositing the third conductive material includes depositing the third conductive material to a substantially uniform thickness of between about 0.4 mils and about 0.8 mils.

13. The method according to claim 12, wherein the substantially uniform thickness is approximately 0.5 mils.

14. The method according to claim 1, further comprising the step of depositing a fourth conductive material on the opposite sides of the substrate and on the sidewall of the via prior to the step of depositing the first conductive material.

15. The method according to claim 14, wherein the fourth conductive material comprises one of palladium and platinum.

16. The method according to claim 14, wherein the step of depositing the fourth conductive material includes depositing the fourth conductive material to a substantially uniform thickness of between about 30 micro-inches and about 200 micro-inches.

17. The method according to claim 16, wherein the substantially uniform thickness is between about 70 micro-inches and about 80 micro-inches.

18. The method according to claim 1, wherein the substrate comprises a resin material.

19. The method according to claim 18, wherein the resin material is a glass-filled resin material.

20. The method according to claim 1, further comprising the step of etching the first and third conductive materials so as to form wiring patterns on the opposite sides of the substrate.

21. A method of making a conductive via in an insulator circuit board substrate adapted to carry wiring patterns on at least a first surface and a second surface thereof, comprising the steps of:

providing an insulator substrate;

5 forming a via having a sidewall in the insulator substrate between the first surface and the second surface by penetrating the insulator substrate;

 depositing a first conductive layer on the first surface and on the sidewall of the via such that the first conductive layer substantially covers the first surface of the insulator substrate and the sidewall of the via while leaving an opening in the via;

10 depositing a conductive material in the opening of the via to plug the via such that the opening does not extend completely through the via in a direction generally perpendicular to the first and second surfaces; and

 forming a second conductive layer on the first surface of the insulator substrate subsequent to the forming of the via, the depositing of the first conductive layer, and the

15 depositing of the conductive material in the opening such that the second conductive layer forms a substantially flat surface extending across substantially all of the first conductive layer and across an end portion of the conductive material in the via so that the end portion is covered by and makes direct contact with the second conductive layer.

22. The method according to claim 21, further comprising the step of etching the first and second conductive layers so as to form a wiring pattern on the first surface of the insulator substrate, the wiring pattern being electrically connected through the via to the second surface.

23. The method according to claim 21, further comprising the step of masking the insulator substrate with a stencil to permit selective filling of the opening prior to the step of depositing the conductive material in the opening, wherein the conductive material is deposited so as to completely fill the opening.

24. The method according to claim 21, wherein the step of depositing the second conductive layer comprises one of feature plating and panel plating and the first and second conductive layers comprise copper.

25. The method according to claim 21, wherein the conductive material is one of a conductive ink, a conductive paste, and a conductive adhesive.

26. The method according to claim 21, wherein the insulator substrate comprises a glass-filled resin material.

27. A method of preparing a printed circuit board (PCB), comprising the steps of:
forming a hole on at least one side of a substrate to form a via extending at least partially through the substrate to an internal surface of the substrate, the via having a sidewall;

5 depositing a first conductive material on said one side of the substrate and on the sidewall of the via such that the via has an opening;

masking the substrate with a stencil;

10 filling the opening with a second conductive material by moving the second
conductive material through an opening in the stencil to plug the via such that the opening
in the via does not extend completely through the via in a direction generally perpendicular
to said one side of the substrate; and

 depositing a third conductive material on the first conductive material and on an
end of the second conductive material in the opening.

28. The method according to claim 27, wherein the step of depositing the first
conductive material comprises electrolytically plating copper to a substantially uniform
thickness exceeding approximately 0.2 mils.

29. The method according to claim 27, wherein the second conductive material is a
conductive ink.

30. A method of preparing a printed circuit board (PCB), comprising the steps of:
forming a plurality of holes on at least a first surface of a substrate to form a
plurality of vias extending at least partially through the substrate to a second surface of the
substrate, the vias having sidewalls;

5 depositing a first conductive material on at least the first surface of the substrate
and on the sidewalls of the vias such that each of the vias has an associated opening;

 masking the substrate with a stencil to selectively cover a first predetermined
number of the vias and reveal a second predetermined number of the vias;

10 filling the openings associated with the revealed vias with a second conductive
material; and

 depositing a third conductive material on the first conductive material and on ends
of the second conductive material in the filled openings.

31. The method according to claim 30, wherein the step of depositing the first
conductive material comprises electrolytically plating copper to a substantially uniform
thickness exceeding approximately 0.2 mils.

32. A circuit board comprising:

a substrate having at least first and second generally parallel surfaces and a via extending through the substrate from the first surface to the second surface, the via having a sidewall;

5 a first conductive layer extending over substantially all of the first surface and the via sidewall;

a conductive material positioned within the via and surrounded by the first conductive layer extending over the via sidewall, the conductive material plugging the via such that the via has no opening extending from the first surface to the second surface; and

10 a second conductive layer extending over substantially all of the first conductive layer on the first surface, and over an end portion of the conductive material positioned within the via.

33. The circuit board of claim 32 wherein the first and second surfaces are exterior surfaces of the substrate.

34. The circuit board of claim 32 wherein the first conductive layer comprises copper.

35. The circuit board of claim 34 wherein the second conductive layer comprises copper.

36. The circuit board of claim 32 wherein the conductive material positioned within the via is selected from the group consisting of conductive inks, conductive pastes, and conductive adhesives.

37. The circuit board of claim 36 wherein the conductive material is a conductive ink.

38. The circuit board of claim 37 wherein the conductive ink comprises at least one of silver, copper, and a noble metal.

39. The circuit board of claim 32 wherein the first and second conductive layers are adapted to be etched to thereby form wiring patterns on either one or both of the first and second surfaces.

40. The circuit board of claim 32 wherein the substrate comprises a resin material.

41. A circuit board comprising:

a substrate having at least first and second generally parallel surfaces and a via extending through the substrate from the first surface to the second surface, the via having a sidewall;

5 a first conductive layer extending over substantially all of the first surface, the second surface, and the via sidewall;

a conductive material positioned within the via and surrounded by the first conductive layer extending over the via sidewall, the conductive material plugging the via such that the via has no opening extending from the first surface to the second surface;

10 a second conductive layer extending over substantially all of the first conductive layer on the first surface, and over a first end portion of the conductive material positioned within the via; and

15 a third conductive layer extending over substantially all of the first conductive layer on the second surface, and over a second end portion of the conductive material positioned within the via.

42. The circuit board of claim 41 wherein the first and second surfaces are exterior surfaces of the substrate.

43. The circuit board of claim 41 wherein the second and third conductive layers each comprise copper.

44. The circuit board of claim 41 wherein the first, second and third conductive layers are adapted to be etched to thereby form wiring patterns on either one or both of the first and second surfaces.

45. The circuit board of claim 41 wherein the substrate comprises a resin material.